



Validation & Verification of Safety Critical Systems in the Aerospace Domain.

Workshop: Teststrategien und -techniken für Onboardsysteme in der Luft- und Raumfahrt
07.10.2008

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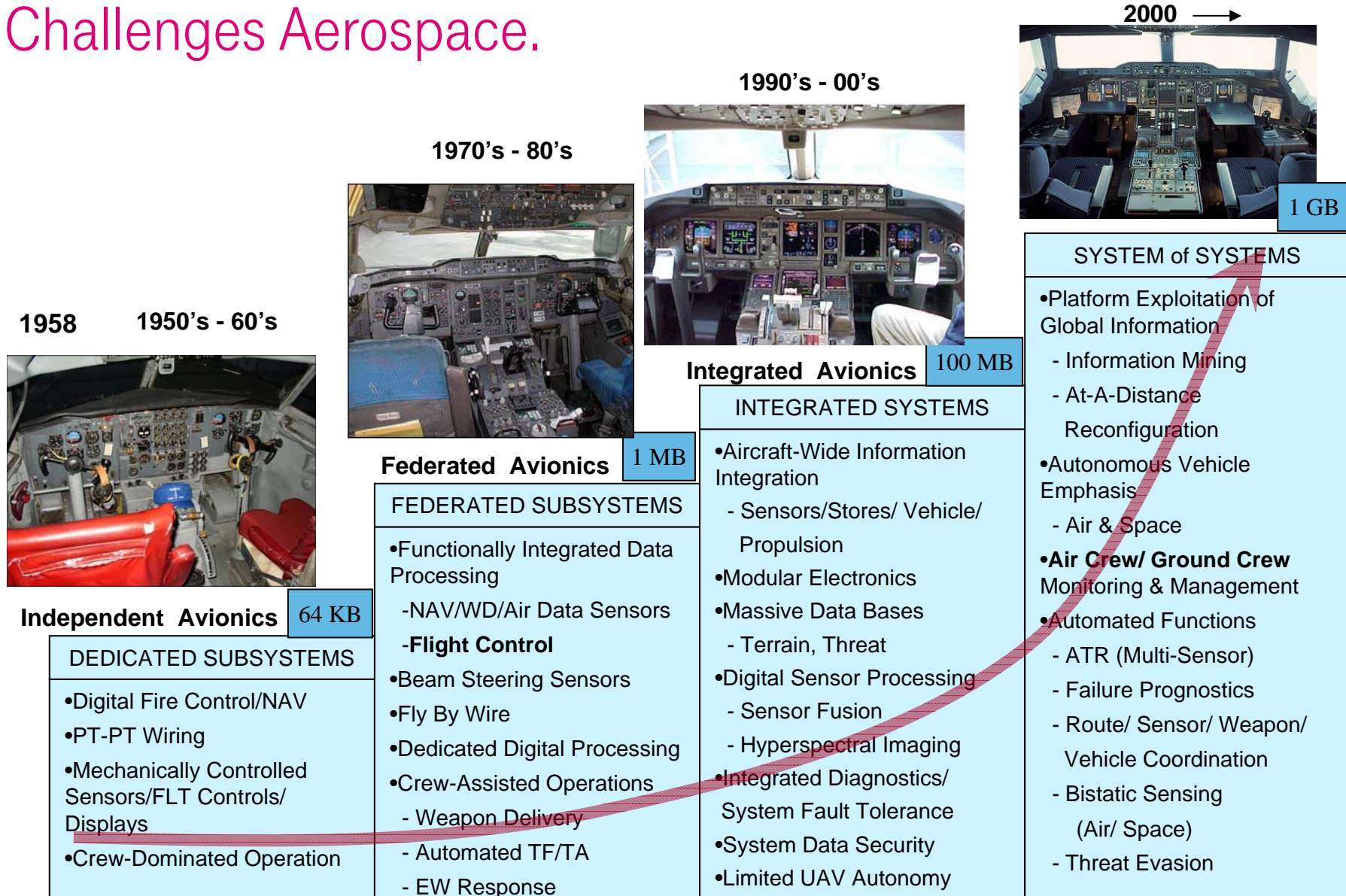


Structure.

- **Challenges in Aerospace and Automotive**
- Fields of Activities
- V&V Strategy – Theory
 - Requirements
 - Elements of the Strategy
 - Optimization
- V&V Strategy – Experience
 - Effort – Bad Case – Good Case
- Example „Early Verification“
- Example „End-to-End Test“
- 2 Automation Concepts



Challenges Aerospace.



Challenges Automotive.



Elektronische Einspritzung
 Check Control
 Geschwindigkeitsregler
 Zentralverriegelung
 ...

1970



Elektronische Getriebesteuerung
 Elektronische Klimaregelung
 ASC Anti Slip Control
 ABS Anti Blocking System
 Telefon
 Sitzheizungssteuerung
 Autom. Spiegelabblendung

1980



Navigationssystem
 CD-Wechsler
 ACC Active Cruise Control
 Airbags
 DSC Dynamic Stability Control
 Adaptive Getriebesteuerung
 Rollstabilisierung
 Xenon Licht
 BMW Assist
 RDS/TMC
 Spracheingabe
 Notruf

1990

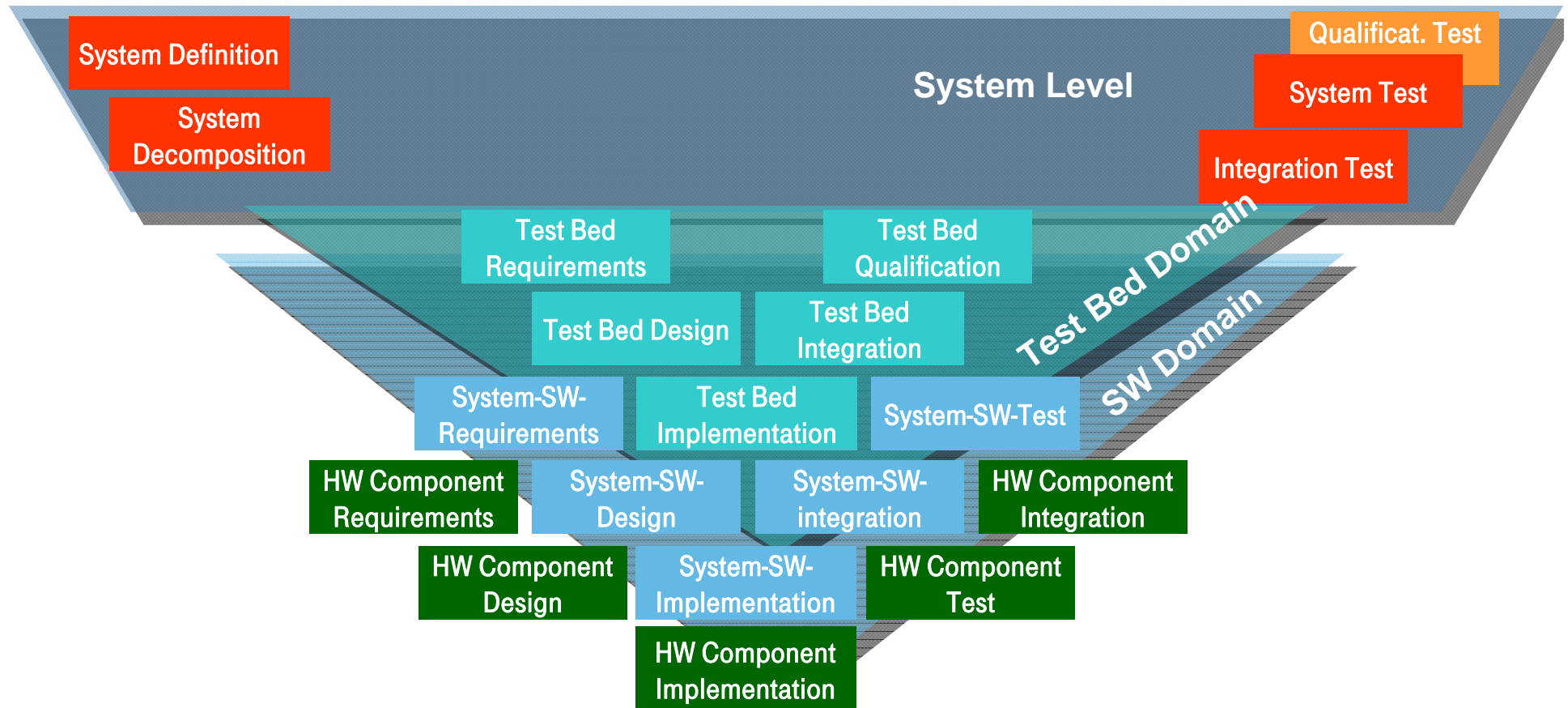


ACC Stop&Go
 BFD
 ALC
 KSG
 Internet Portal
 GPRS, UMTS
 Telematics
 Online Services
 Blue-Tooth
 Car Office
Local Hazard Warning
 Integrated Safety System
 Steer/Brake-By-Wire
 I-Drive
 Spurhalteunterstützung
 Personalisierung
 Force Feedback Pedal

2000



Effort.

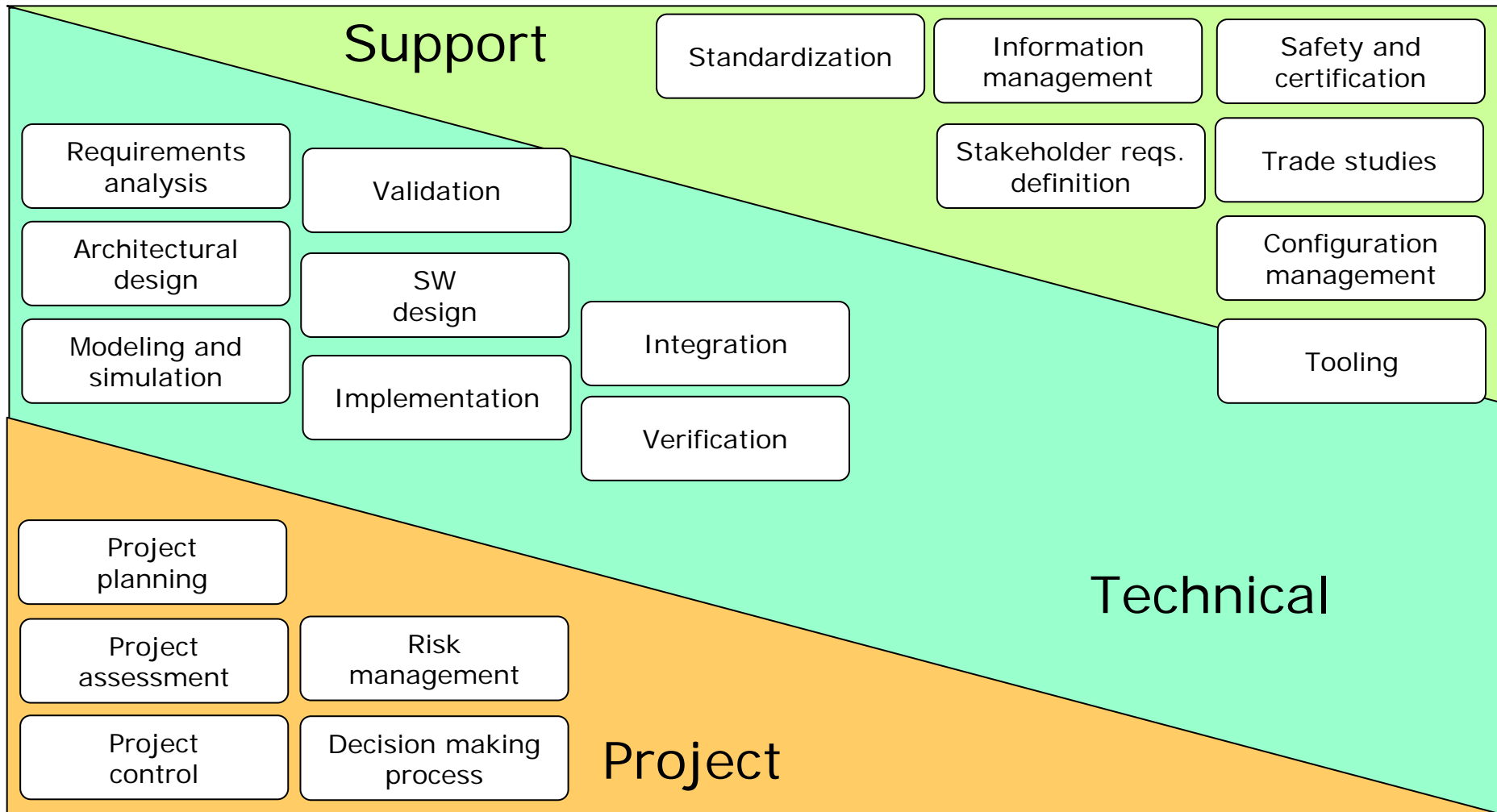


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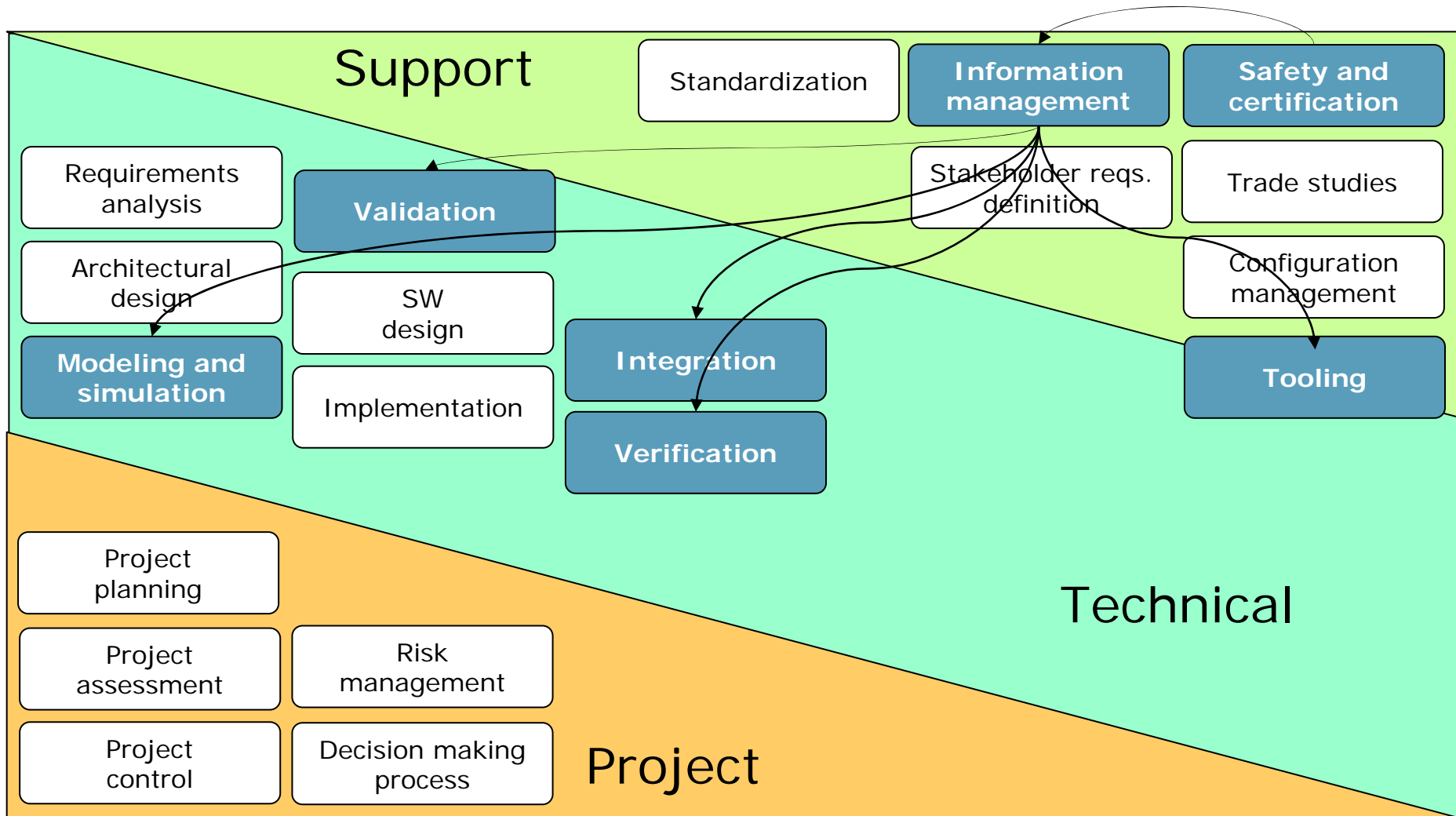
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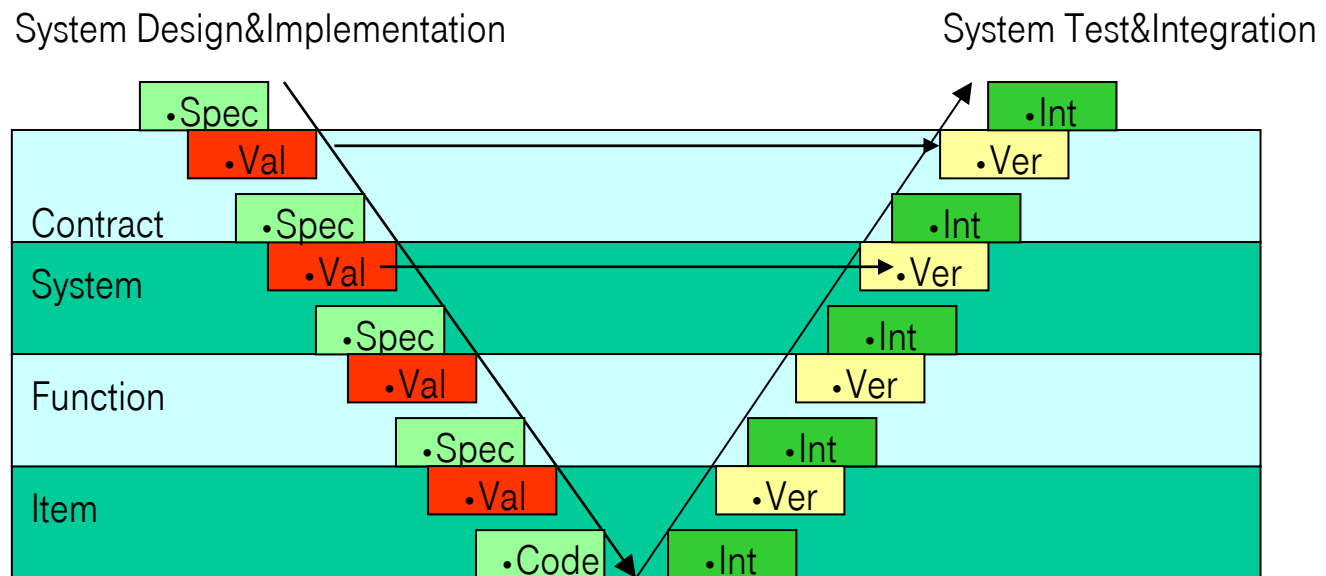
Fields of Activities.



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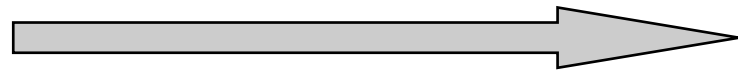


Process.



What to Deal With - Methods of Validation and Verification.

- Simulation
- Analysis, engineering judgement
- Similarity of requirements or design
- Demonstration, prototyping or mock-up
- Reviews or audits
- Inspection
- Test
- Operational trials



- Flight test
- Aircraft ground test
- System integration test
- HW-SW integration test (Bench)
- SW-SW integration test
- Coding unit test



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Let's Find an „Optimized V&V Strategy“.

From Theory.....



..... To Experience



Requirements on an Optimized V&V Concept.

“Sufficient” Test Coverage

Sufficient Evidence of the System Safety

Limitation of the Effort to Reasonable Budgets

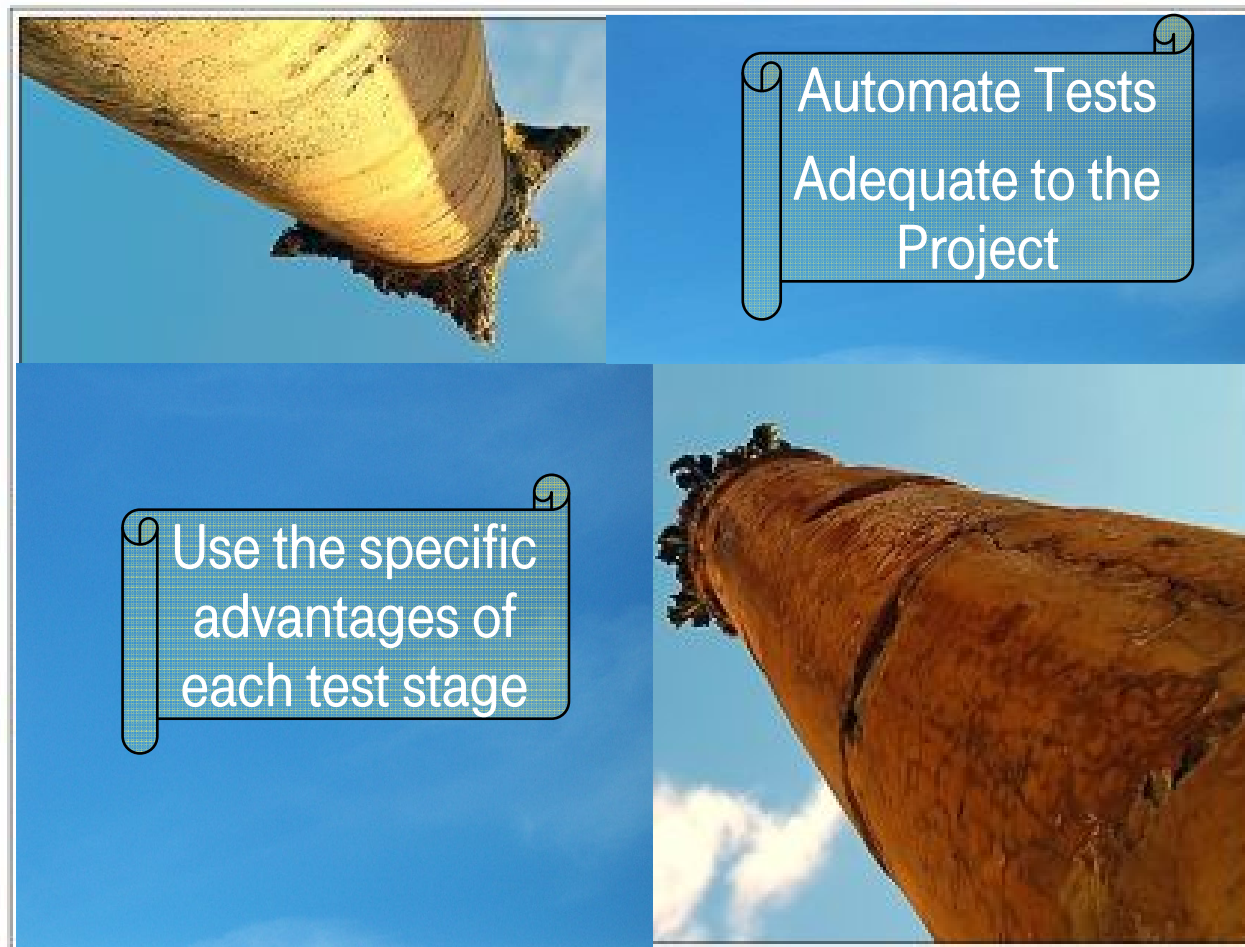
Consideration of the Project Development Phase



Elements of a Good V&V Strategy.



Essential Columns of the V&V Strategy – Focusing.



Optimized Strategy (1).

Use the specific advantages of each test stage

▪ Verify requirements&functions <u>early</u>	➔	Safe Money
▪ Realize <u>end to end</u> tests	➔	Assure user's needs
▪ <u>Coordinate</u> all test stages	➔	Integrated test concept
▪ Realize the <u>coherence</u> of functions and test	➔	Coverage and traceability



Optimized Strategy (2).

Automate Tests Adequate to the Project

▪ Find out the project adequate automation method	➔	Reduction of initial and repetitive effort
▪ Establish <u>automated</u> tests early	➔	Reduction of repetitive effort
▪ Use data bases and <u>generators</u>	➔	Reduction of document effort



Structure.

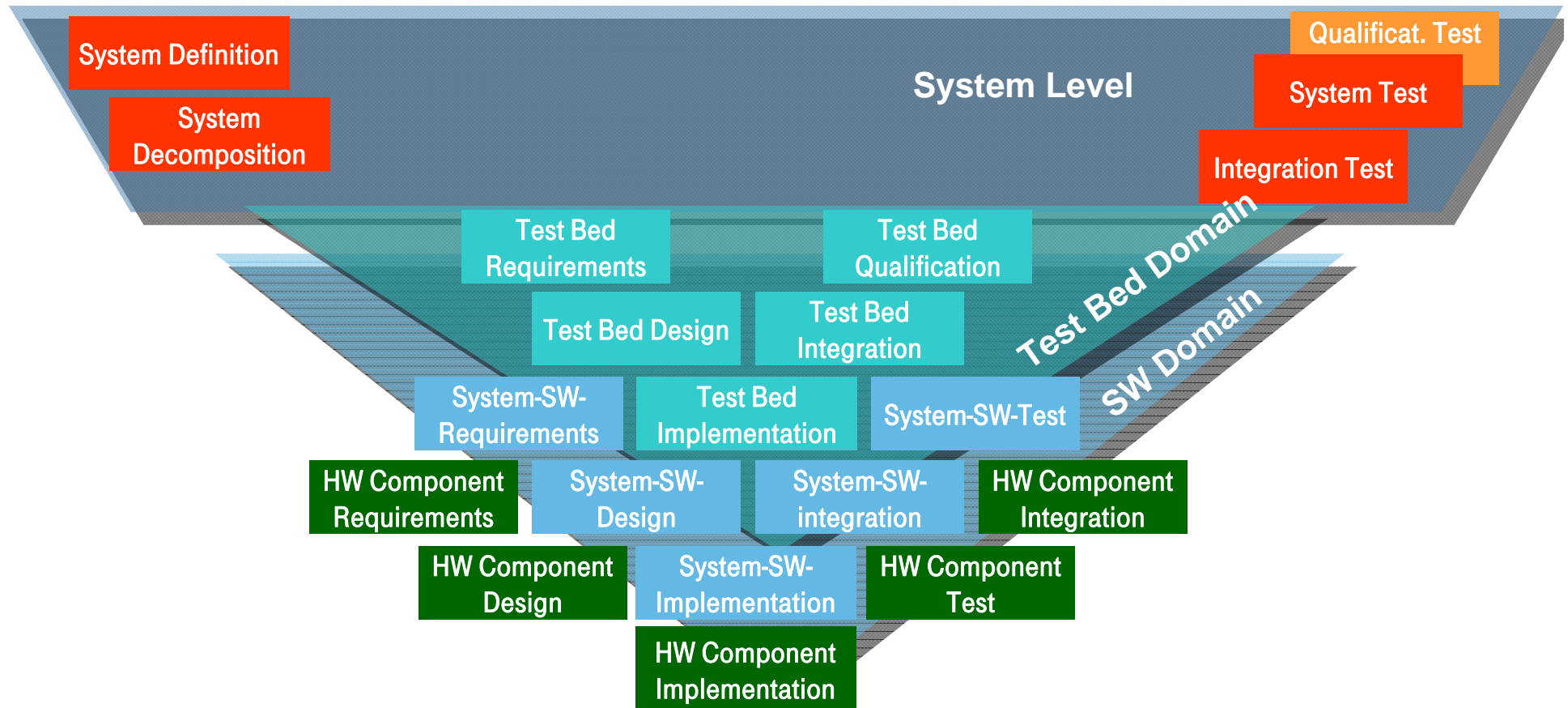
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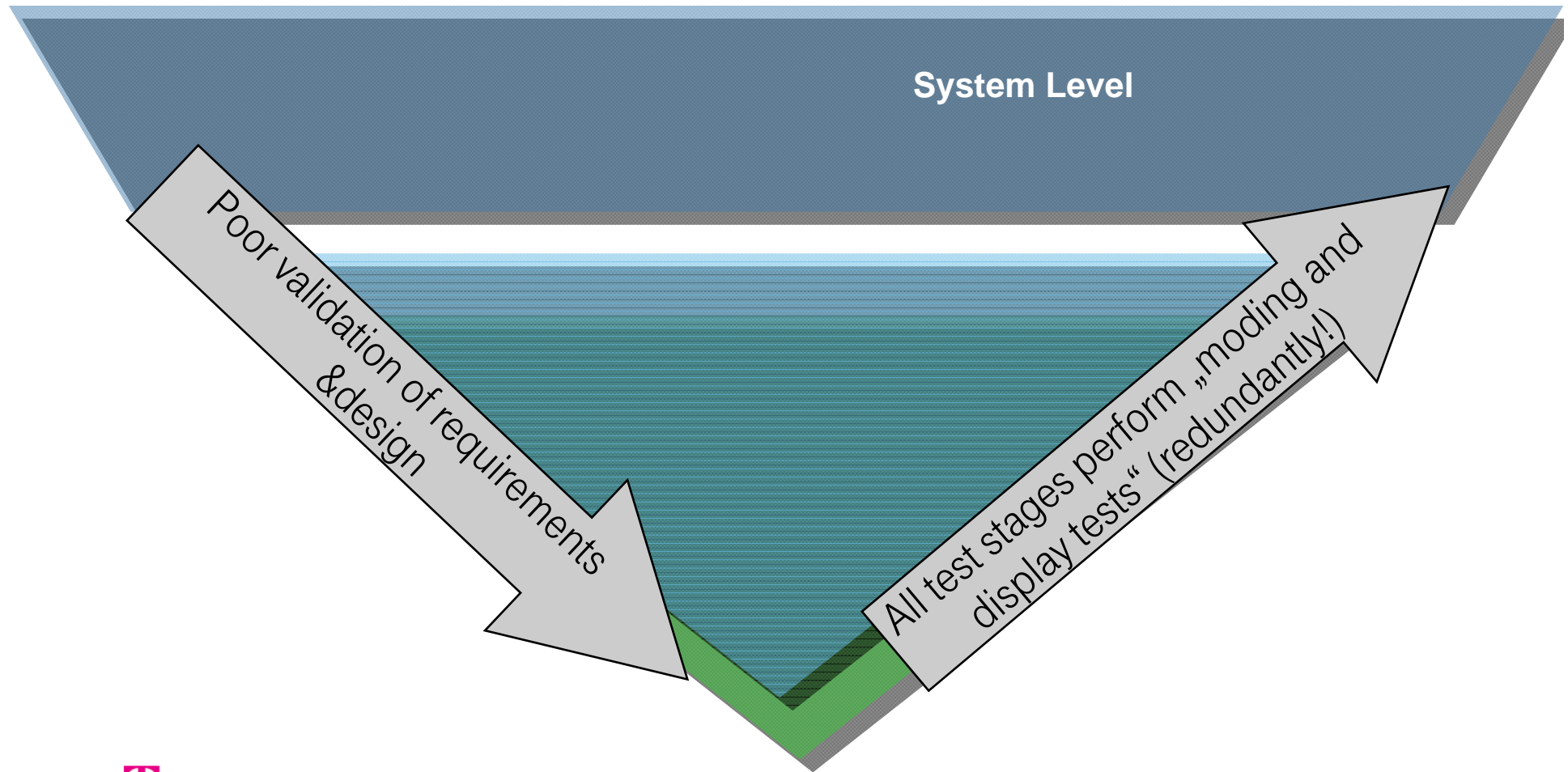
Experience.



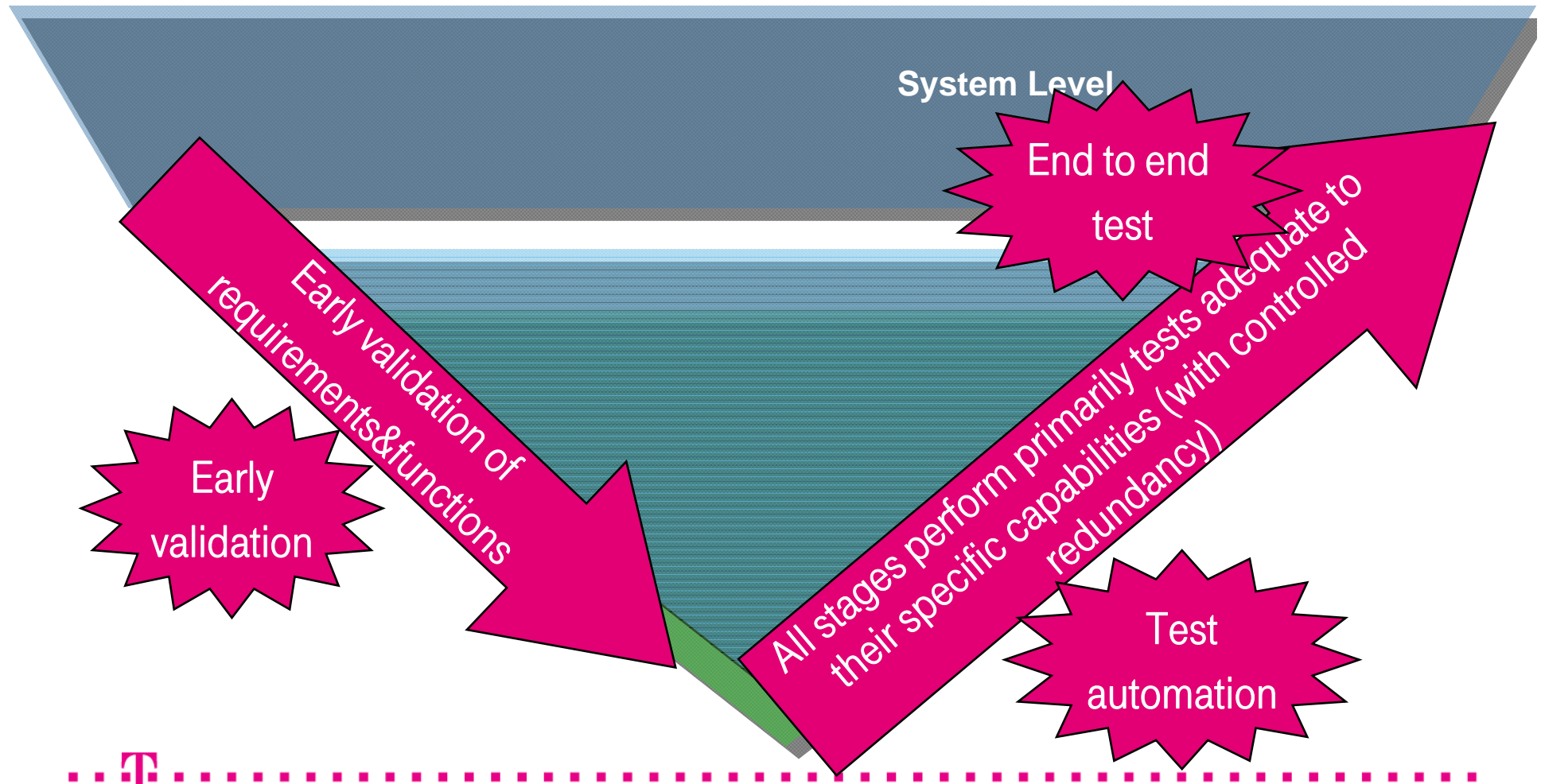
Effort.



„Bad Case“.



„Good Case“.

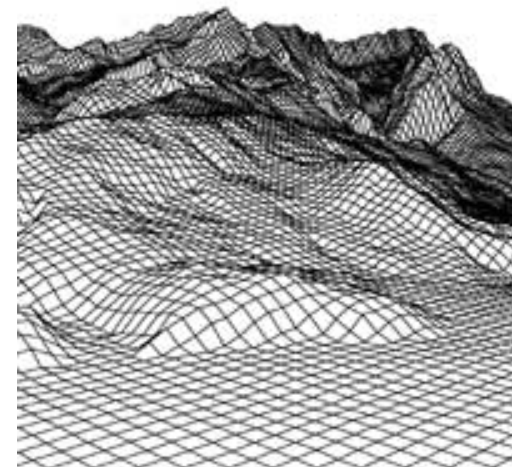
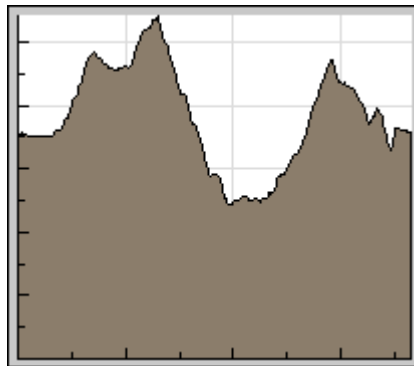


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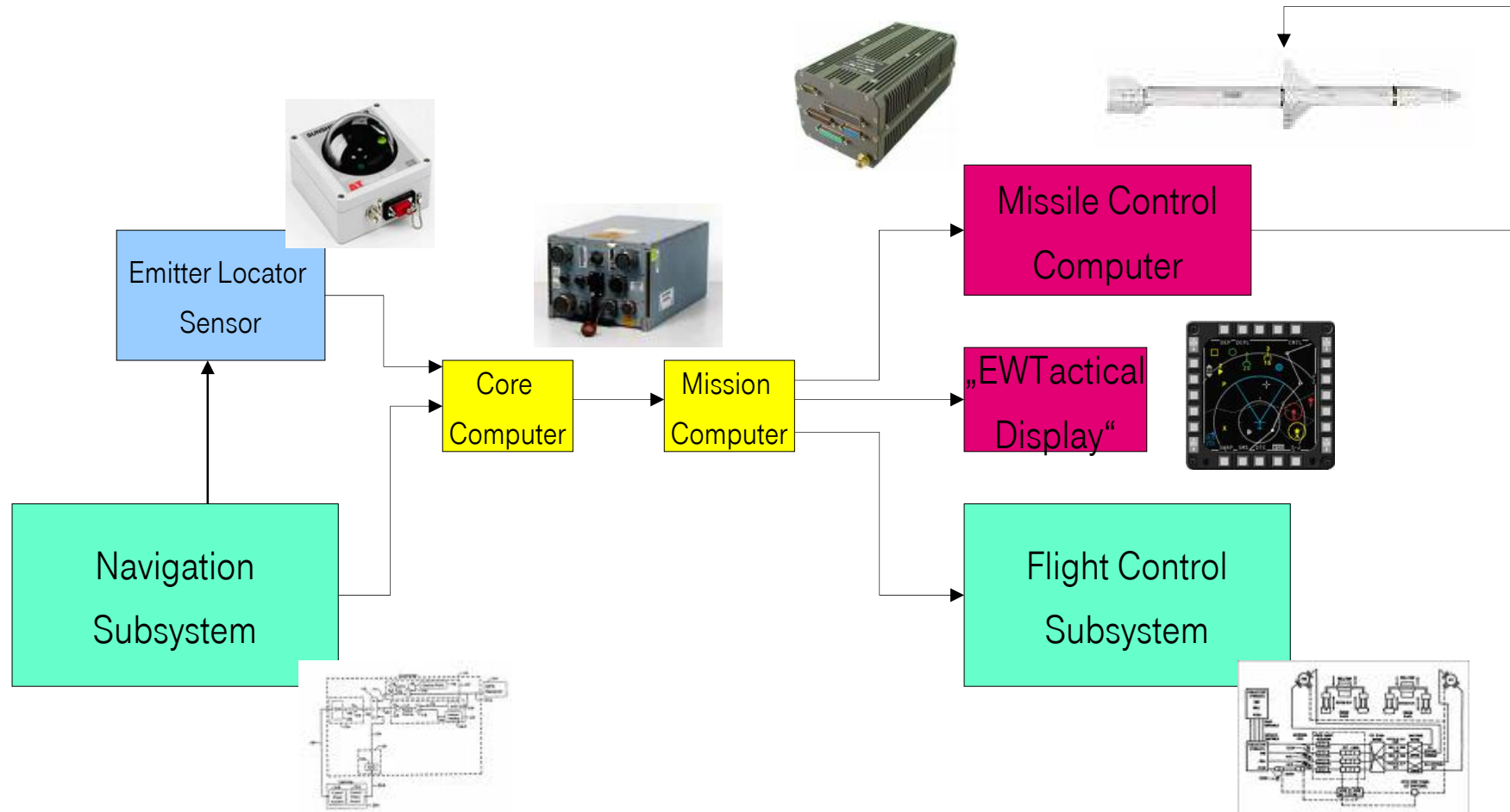
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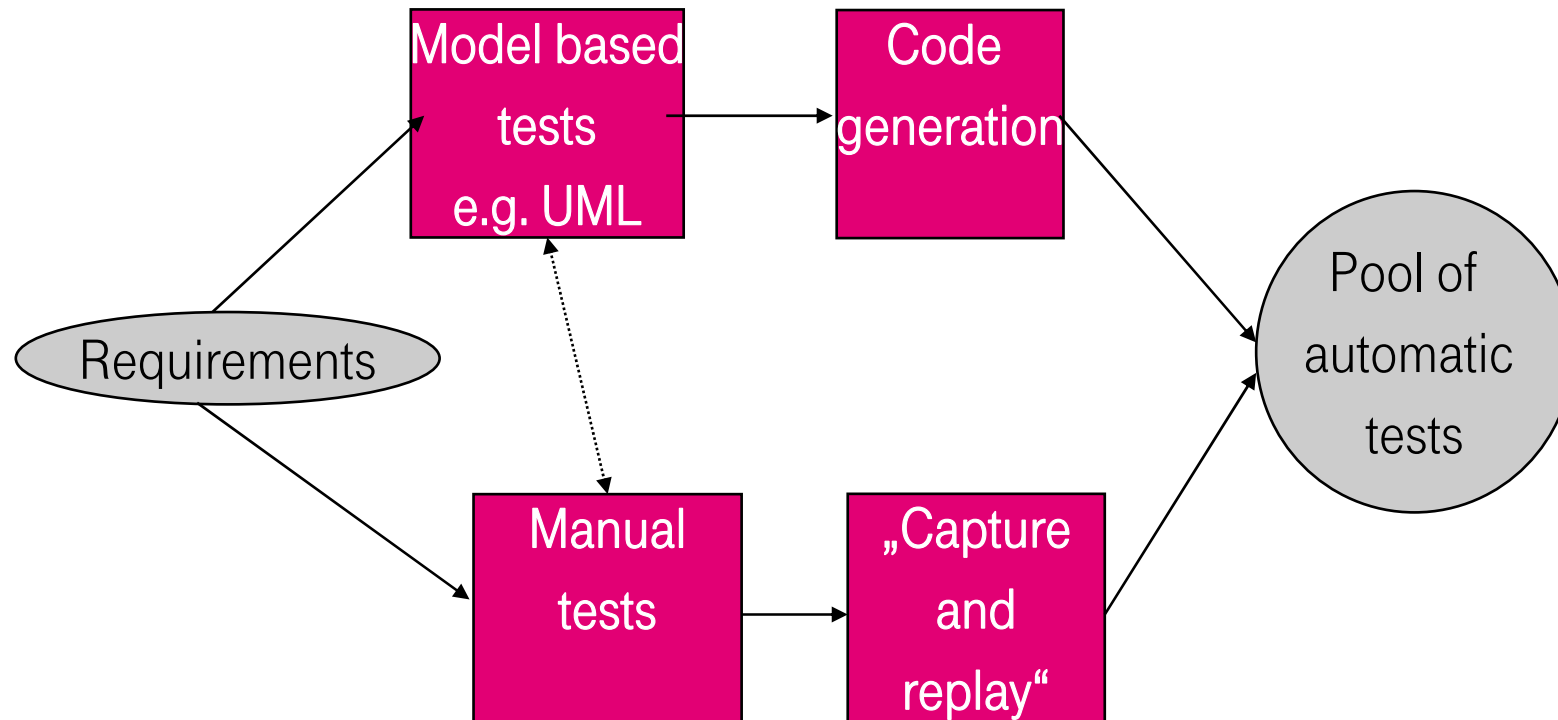
Example Early Verification - Terrain Referenced Navigation.



Example End-to-End Test – EW Chain.



Two Automation Concepts.





Vielen Dank für Ihre Aufmerksamkeit!

